THE GENERIC LIMITS OF PLUCHEA AND TESSARIA

(INULEAE, ASTERACEAE).

H. Robinson and J. Cuatrecasas
Smithsonian Institution, Washington, D.C. 20560.

During recent efforts to determine various collections of Compositae from Peru, a number of specimens with field identifications as Eupatorium and Baccharis were identified as the recently described species, Tessaria zamalloae Cabrera. While resolving the problem of identification a new problem was encountered regarding generic limits. A solution to the generic problem is suggetsed here.

The various genera of the Inuleae subtribe Pluchinae have been reviewed in tabular form by Randeria (1960) in her study of the genus Blumea. Many of the genera of the subtribe such as Blumea and Laggera belong to a group distinguished by being essentially herbaceous and by having phyllaries more like those of the tribe Astereae. Genera of this group not or inadequately noted in previous summaries are Pseudoconyza Cuatr. of Latin America and Merrittia Merrill of the Philippines. Outside of this group are the two genera Tessaria and Pluchea which are usually shrubs or trees and which have broader or coarser usually more tightly imbricated phyllaries without discolored tips. The present generic problem is restricted to the latter two genera.

Tessaria was described by Ruiz and Pavon in 1794 and two species were given in 1798. Both species are generally recognized as one species, T. integrifolia R. & P. The species ranges from Central America south to Argentina. Pluchea was described by Cassini in 1817 on the basis of Conyza marylandica Michx. which equals Pluchea camphorata (L.) DC. A third genus has been described in the complex, Berthelotia DC. described in 1836 based on B. lanceolata DC. originally from India. Attempts by various authors to compare the genera ultimately produced a broad concept of Pluchea including species from North and South America as well as Europe, Asia and Africa. Species of Berthelotia were at times placed in Tessaria but these African and Asian species have more recently been included in Pluchea. The genus Tessaria has been retained for a group of about four species mostly in souhtern South America and supposedly distinguished by having fewer male flowers in the head and having more differentiated spreading inner phyllaries (Hoffmann, 1894). Three of the species of Tessaria have been treated for Argentina by Cabrera (1939).

An initial survey of Tessaria is sufficient to see great differences between the species. Only two of the four species

treated by Cabrera, T. integrifolia and T. absinthioides actually have fully differentiated prominently recurving inner phyllaries, and only T. integrifolia commonly shows the single male flower per head that is used by some as a generic character. Further investigation shows that two other South American species T. dodoneaefolia and T. zamalloae are actually closer to various African and Asian species that have been placed in Pluchea and evenly closer to Pluchea chingoyo (H.B.K.) DC. of Peru. Two conflicting generic concepts exist in the two geographical areas. A final broader survey of both genera has shown a wealth of character differences without clear indication of marked phyletic breaks. A representative series is studied here in an attempt to fix a possible natural division between the genera, if any.

Various character differences found among the species of Tessaria and Pluchea seem best treated in sequence. The following series is arranged in a generally progressive order starting with characters more restricted to typical Pluchea.

Pappus setae deciduous. The setae are very fragile in some of the species of Pluchea including P. salicifolia (Mill.) Blake and the type of the genus P. camphorata. The setae are more persistant though completely separate in material seen of P. odorata (L.) Cass. Pappus setae are increasingly persistant in the intermediate species such as P. indica (L.) Less., P. dioscoridis (L.) DC. and Tessaria dodoneaefolia (Hook. & Arn.) Cabrera. In T. zamalloae Cabrera the setae are firmly attached though reduced in number, being widely separated on the achenes of the male flowers. To a slight extent in T. absinthioides and more especially in T. integrifolia and P. lanceolata the pappus setae become very broad and extensively fused at the base. These last tend to form a sheath on the achenes. The tips of the setae are usually slender, being distinctly fringed and clavate in only P. lanceolata of the species studied.

Phyllaries. In typical Pluchea species including P. camphorata, P. salicifolia, P. suaveolens (Vell.) Kuntze and P. odorata the inner phyllaries are only slightly differentiated and have only slightly spreading tips during anthesis. There is a considerable difference in the appearance in the involucres of other species such as P. indica, P. dioscoridis, P. lanceolata, P. chingoyo, T. dodoneaefolia and T. zamalloae. These six species, the first three Asian and African and the second three South American, all have more coriaceous tightly appressed outer phyllaries in a turbinate form with more deciduous erect-spreading to slightly recurved inner phyllaries. Bridging the gap between the latter and typical Pluchea is P. fosbergii Cooperrider & Galang described in 1965, a sterile hybrid between P. odorata and P. indica that has been produced on many Pacific Islands. As already stated, the extremely recurved long inner phyllaries occur only in Tessaria integrifolia and T. absinthioides, species

which show many important differences from each other in other structures.

Glands on female corollas. Female corollas with short-stalked capitate glands on one or more lobes are nearly correlated with the distribution of undifferentiated inner phyllaries. Such corollas are found in typical Pluchea and are lacking in Tessaria or most of Berthelotia. Unfortunately for the correlation, there are glands on the lobes in most specimens of P. indica even in areas where P. odorata does not seem to be available to hybridize.

Glands on lobes of male corolla. Numerous capitate glands occur on the outer surface of the male corolla lobes in all typical Pluchea and in most other species in the complex such as P. odorata, P. indica, P. lanceolata, P. chingoyo, Tessaria dodoneaefolia, T. zamalloae and T. absinthioides. A species with no glands on the corolla lobes is P. dioscoridis but in this species glands of the same type are usually clustered on the anther appendages. Anther appendages often have glands in P. indica and in material seen of P. bojeri (DC.) Humb., these species having glands on both the corolla lobes and anther appendages. Only Tessaria integrifolia of the species examined never has capitate glands on either the corollas or the anther appendages.

Hairs or glands on achene. Typical Pluchea has achenes distinctly pubescent. Hairs have been seen in P. camphorata, P. salicifolia and P. odorata and glands in P. suaveolens. A few setae have been seen on achenes of P. indica from Asia. Pubescent achenes occur again in P. chingoyo, P. fiebrigii n. sp., Tessaria dodoneaefolia and T. zamalloae. Most of Berthelotia and both Tessaria integrifolia and T. absinthioides have glabrous achenes. In this respect more typical Tessaria differs from other American species and stands closer to the species of Africa and Asia. The distribution of this character runs counter to trends shown by the distribution of glands on the male corollas or the degree of differentiation of inner phyllaries.

Hairs on lobes of male corolla. Two species studied have distinctive long hairs on the outer surface or margin of the male corolla lobes. In Pluchea lanceolata these hairs are mixed with glands. In Tessaria integrifolia the hairs are the only pubescence on the corollas.

Short cells at tips of anther tails. The tails of the anthers of typical Pluchea and almost all other members of the complex have tips with rather elongate cells which sometimes form a digitate cluster. In three species examined the apices of the tails are blunter. In Pluchea lanceolata the apical cells seem to turn toward the side so that any projections are

lateral. In Tessaria integrifolia there is no clear indication of such distortion but the tails are blunt at the tip with rather quadrate apical cells. Some specimens of T. absinthioides have short apical cells as in T. integrifolia. The blunt tips of the tails are a third character shared by Pluchea lanceolata and Tessaria integrifolia, two species that show no other reasons to be considered particularly closely related.

Pointed anther appendages. Pluchea and Berthelotia species all show a distinctly rounded apex on the anther appendages. Tessaria integrifolia has anther appendages rather sharply pointed. There is a tendency for somewhat pointed appendages in T. absinthioides. The appendages of Pluchea fiebrigii become unusually elongate and very narrowly rounded but are not sharp as in typical Tessaria.

Tips of male corolla lobes. Almost all species of the complex, including all species that were previously placed in Pluchea, have rather evenly tapered tips on the lobes of the male corolla. The margins of the lobes are usually crenulate or papillose with projecting cells. Tessaria integrifolia is very distinct in the thickened entire margins and the rostrate or narrowly acuminate tips. Such an acuminate tip is also seen in Pluchea fiebrigii described below and in some material of Tessaria absinthioides.

Shape of male corolla. Only Tessaria integrifolia among all the species studied has shown two very distinctive features of the male corolla. In this species the lobes are very elongate, being divided to below the middle of the corolla. Also, the base of the corolla is differentiated into a very short but distinct tube. The whole corolla has unusually thick and firm tissue. No other species resembles T. integrifolia in these features. The presence of only one male flower per head is also known from only this species but the character is not constant, the variety polyandra Cabrera may have 3-5 male flowers.

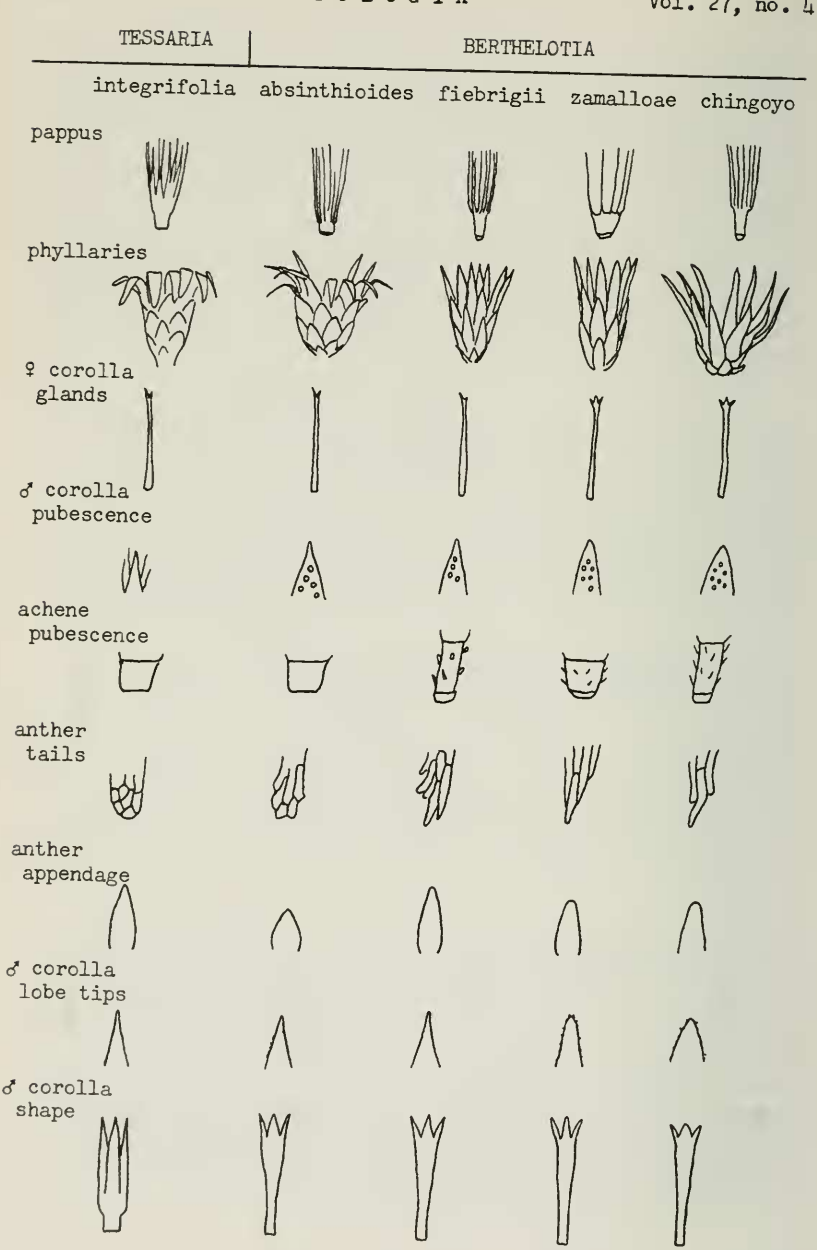
The evidence, with a pattern of only partially correlated characters, suggests a continuous intergrading series from typical Pluchea to typical Tessaria. There are minor elements such as Pluchea lanceolata with the enlarged tips on the pappus setae, the African species with glands on the anther appendages and the more macroscopically evident group in South America, including Tessaria dodoneaefolia, T. zamalloae and Pluchea fiebrigii, which have narrower outer phyllaries and heads with a reduced number of female flowers. There is also such evidence as achene pubescence and corolla hairs that seem to conflict with most other evidence such as the form of the inner phyllaries. Still, the overall pattern continues to indicate one large series with three possible subgroupings, Pluchea, Berthelotia and

Tessaria.

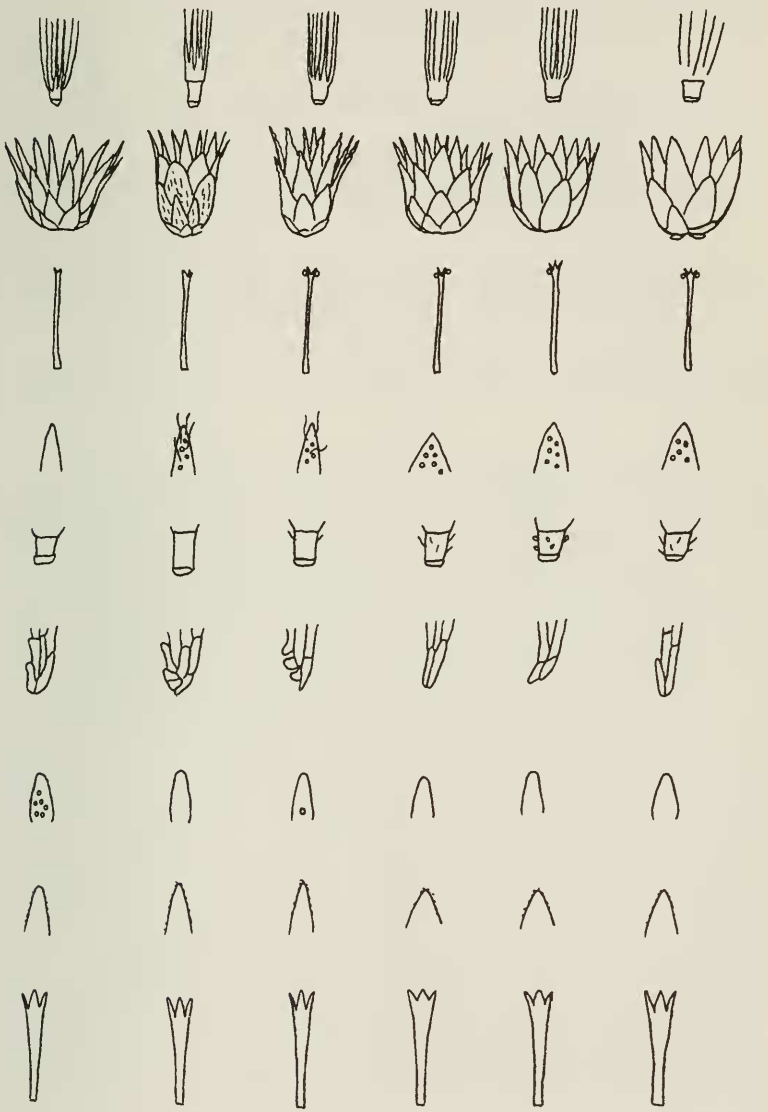
The three basic elements, Pluchea, Berthelotia and Tessaria, represent the most obvious groupings of species. Pluchea would represent those American species with the least differentiated inner phyllaries, with glands on the female and male corollas and with pubescent achenes. Berthelotia would represent the Asian, African and South American species with more erect-spreading inner phyllaries, with usually glabrous female corollas, with glands on either the male corollas or on the anther appendages and with achenes either pubescent or glabrous. Tessaria would represent the Latin American species with highly differentiated inner phyllaries that become strongly reflexed, with glabrous female corollas and glabrous achenes. It is unfortunate that this three-part concept breaks down in two critical points.

The distinction between Pluchea and Berthelotia is obscured by the demonstrated hybridization between P. odorata and P. indica. Even without the hybrid the presence of glands on the female corollas and the presence of some setae on the achene in P. indica would weaken the distinction. The distinction between Berthelotia and Tessaria is also weakened by the combinations of characters seen in the two species, T. absinthioides and Pluchea fiebrigii. Though lacking the distinctive corolla features of Tessaria integrifolia, there is a tendency toward acuminate tips on the corolla lobes, more pointed anther appendages, blunter anther tails and more differentiated reflexed inner phyllaries in T. absinthioides, and there are acuminate corolla lobe tips in Pluchea fiebrigii. The T. integrifolia type corolla lobe tips in P. fiebrigii contrast markedly with the rest of the plant which has the distinctive appearance of the T. zamalloae-T. dodoneaefolia group. The complete mixture of Tessaria and Pluchea features in T. absinthioides suggests that here as between Berthelotia and Pluchea there is hybridization. Actually, there seems to be no way of explaining many of the mixtures of characters in the Pluchea - Berthelotia - Tessaria series except by hybridization among various and often rather unrelated species.

In spite of the evidence of interaction throughout the Tessaria - Pluchea series there is a great disadvantage in reducing the series to a single genus. Tessaria is the older name and name changes in many familiar species would be required. The logical answer is to maintain the genus Tessaria as a single species distinguished by its uniquely formed male corolla. Such a distinction would correlate with the dendroid nature of the species emphasized by Cabrera (1959). In this way the few species previously appended to Tessaria would fall into Pluchea. Tessaria absinthioides would also fall into Pluchea in spite of the possibility of partial derivation from T. integrifolia. The genera can be distinguished by the following key.


TESSARIA
BERTHELOTIA
integrifolia
absinthioides
fiebrigii
zamalloae
chingoyo
pappus
phyllaries
♀ corolla glands
♂ corolla pubescence
achene pubescence
anther tails
anther appendage
♂ corolla lobe tips
♂ corolla shape

BERTHELOTIA			PLUCHEA		
dioscoridis	lanceolata	indica	odorata	suaveolens	camphorata



1. Trees; male corollas mostly solitary, contracted with short tube at base, lobes over half of corolla length

Tessaria

1. Shrubs; male corollas never solitary, without distinct basal tube, lobes less than three times as long as wide

Pluchea

The following three species are transferred to Pluchea and one species described as new.

Pluchea absinthioides (Hook. & Arn.) H.Robinson & J.Cuatrecasas, comb. nov. Baccharis absinthioides Hook. & Arn., Bot. Capt. Beech. Voy. 57. 1830.

Pluchea dodoneaefolia (Hook. & Arn.) H.Robinson & J.Cuatrecasas, comb. nov. Eupatorium dodoneaefolium Hook. & Arn., Comp. Bot. Mag. 2: 44. 1836.

Pluchea zamalloae (Cabrera) H.Robinson & J.Cuatrecasas, comb. nov. Tessaria zamalloae Cabrera, Not. Mus. La Plata, Bot. 19: 201. 1959.

Pluchea fiebrigii H.Robinson & J.Cuatrecasas, sp. nov.
Planta frutescens usque ad 2 m alta parce ramosa. Caules teretes brunneoli dense breviter puberuli. Folia alterna lineari-elliptica 20-40 mm longa 4-5 mm lata pauce serrulata base anguste cuneata ad apicem argute acuta utrinque dense minute puberula obscure glandulo-punctata. Inflorescentia terminalis corymbosa, pedicellis plerumque 1-2 mm longis minute puberulis. Capitulum ca. 7 mm altum; squamae involucri ca. 40 flavescentes 5-6-seriatae plerumque lanceolatae vel lineares 2-6 mm longae usque ad 1 mm latae extus plerumque glabrae margine parce hirsutae vel minute laciniatae interiores facile deciduae; receptaculum planum glabrum. Flores radii ca. 60-70 filiformes ca. 4.0 mm longi 3-4-lobati, lobis non glanduliferis anguste acutis; achaenia ca. 0.8 mm longa ecostata sparse setifera et glandulifera, glandulis non capitatis, carpopodiis distinctis, cellulis multiseriatis; pappus setiformis aliquantum persistentibus, setis ca. 18. Flores disci ca. 8 tubulares ca. 5 mm longi 5-lobati, lobis ca. 0.8 mm longis 0.4 mm latis triangularibus ad apicem breviter rostratis extus multo glanduliferis; thecae antherarum ca. 2.5 mm base digitiferae, appendicibus elliptico-lanceolatis subacutis; styli plerumque argute papillosi; achaenia ca. 0.8 mm longa 0.3 mm lata extus non scleroidea; setae pappi ca. 20-22 base plerumque distinctae contiguae. Grana pollinis ca. 20-25μ diam. valde spinosa.
Type: BOLIVIA: Chuquisaca: Camataqui. 2500 m, 10. 2. 1904. K. Fiebrig 3073 in part (Holotype US).
The species shows the head form of Tessaria dodoneaefolia

and T. zamalloae with rather narrow outer phyllaries and a reduced number of female flowers. The species differs by the narrower leaves, the denser pubescence on the leaves and the more pointed lobes of the male corollas. The anther appendages also seem longer and more narrowly rounded at the tip than usual for the genus.

Literature Cited

Cabrera, A. L. 1939. Las especies Argentinas del genero "Tessaria". Lilloa 4: 181-189, pl. 1-3.

Candolle, A. P. de 1836. Ordo CII. Compositae. Prod. Syst. Nat. 5: 4-695.

Cassini, H. 1817. Aperçu des Genres nouveaux formés par M. Henri Cassini dans la famille des Synanthérées. troisième fascicule. Bull. Sci. Soc. Philom. 1817: 31-34.

Cooperrider, T. S. and M. M. Galang 1965. A Pluchea hybrid from the Pacific. Amer. Journ. Bot. 52: 1020-1026.

Hoffmann, O. 1894. Compositae. in Engler and Prantl, Die Natürlichen Pflanzenfamilien 4 (5): 87-391.

Randeria, A. J. 1960. The composite genus Blumea; a taxonomic revision. Blumea 10: 177-317.

Ruiz, H. and J. A. Pavon 1794. Florae peruvianae et chilensis prodromus. Madrid.

_____ and _____. 1798. Systema vegetabilium florae peruvianae et chilensis. Madrid.